

Adjusted Estimates of Texas Natural Gas Production

Background

The Energy Information Administration (EIA) is adjusting its estimates of natural gas production in Texas for 2004 and 2005 to correctly account for carbon dioxide (CO₂) production. Normally, EIA would wait until publication of the *Natural Gas Annual (NGA)* before revising the 2004 data, but the adjustments for CO₂ are large enough to warrant making the changes at this time.

Prior to 2005, EIA relied exclusively on the voluntary sharing of production data by state and federal government entities to develop its natural gas production estimates. In 2005, EIA began collecting production data directly from operators on the new EIA-914 production survey.¹ At the same time, the Railroad Commission of Texas (TRRC), the agency that collects the data for the state of Texas, updated its own data collection procedures, incorporating among other changes revisions to correctly account for carbon dioxide (CO₂) production. Review of the new EIA-914 data and the TRRC data for 2005 both suggest that the data previously reported to the TRRC and subsequently used by EIA until now are likely to have overstated gross gas production as measured by the TRRC's preferred concept, which intentionally includes production volumes of indigenous CO₂ but excludes non-indigenous CO₂.² Several major producers apparently included significant amounts of non-indigenous CO₂ in their gross withdrawals data reported to the TRRC prior to 2005.

Full wellstreams from oil and gas wells may contain hydrocarbon liquids, water, hydrocarbon gases such as methane, and naturally occurring, indigenous nonhydrocarbon gases such as CO₂. Gross withdrawals³ of natural gas usually contain some CO₂ and, even after processing, dry natural gas may contain up to 2 percent CO₂ and still meet pipeline quality standards. The TRRC approach consistently has been to ask operators to include indigenous, naturally occurring CO₂ in reported gross withdrawals of natural gas, but not to include non-indigenous CO₂ that was injected into a field and subsequently produced. Nevertheless, significant amounts of injected, non-indigenous CO₂ were misreported to the TRRC in the past and included in TRRC gross withdrawal reported volumes. To remedy this, the TRRC recently instructed Texas operators to submit corrected monthly reports starting with January 2005 if they had included injected, non-indigenous CO₂ in reported gross gas production. These reporting corrections impact the published TRRC production volumes, which EIA uses in its estimates of gas production in Texas.

Consequently, previously published EIA estimates included the non-indigenous CO₂ - counted as natural gas production - in estimates of gross withdrawals, marketed, and dry natural gas. It was included in EIA gross withdrawals because it was included in the data reported to the

¹ While the EIA-914 data are not yet official, they recently have been posted on EIA's website. See [Form EIA-914 Monthly Natural Gas Production Report](#).

² Naturally-occurring CO₂ is classified as indigenous. Non-indigenous CO₂ arises from the injection of CO₂ into fields to improve oil recovery. A portion of the injected CO₂ may subsequently be produced at the wellhead. Currently there are 35 approved CO₂ injection projects in Texas fields.

³ According to definitions used by EIA, "gross withdrawals" of natural gas is full wellstream gas less lease condensate, crude oil, water, and nonhydrocarbon gases removed by lease separators. "Marketed production" is gross withdrawals less gas used for repressuring, quantities vented and flared, and nonhydrocarbon gases removed in treating or processing operations. "Dry natural gas" production is marketed production less extraction loss associated with removing liquids from marketed production. As used in the *Natural Gas Monthly*, the term "marketed production (wet)" is the same as "marketed production."

TRRC and EIA used TRRC data. The non-indigenous CO₂ was not separately identified by operators reporting to the TRRC and not separately identified by the TRRC in its reported data, because it was not supposed to be included in gross withdrawals reported to the TRRC. Since marketed production and dry production are estimated using gross withdrawal volumes³, if non-indigenous CO₂ is in EIA's estimates of gross withdrawals, it's also in EIA's estimates of marketed and dry natural gas production, all of which had to be adjusted.

Adjustments

Accordingly, EIA has made three types of revisions and adjustments to Texas natural gas preliminary production estimates published in the *Natural Gas Monthly (NGM)*:⁴

- (1) 2004 preliminary estimates were revised using the more current TRRC data now available.
- (2) 2005 preliminary estimates were revised using the new EIA-914, "Natural Gas Monthly Production Report," survey data.
- (3) The revised 2004 and 2005 estimates were corrected for non-indigenous CO₂. These were the largest changes.

EIA is adjusting its estimates for both 2004 and 2005 because the TRRC reporting changes dramatically affect reported Texas natural gas production levels, not just for 2005 but for previous years as well.⁵ As shown later in the article, adjusting for non-indigenous CO₂ for 2005 but not for 2004 would give the impression that Texas production dropped almost 6 percent in 2005, but this was not the case. In fact, Texas production (adjusted for non-indigenous CO₂) increased substantially during the first half of 2005.

(1) Revisions to Preliminary Estimates for 2004

EIA publishes preliminary natural gas monthly production estimates in the *NGM* and final estimates in the *Natural Gas Annual (NGA)*.⁶ For most of the report months of 2004, EIA made preliminary estimates of Texas marketed natural gas production using preliminary data reported by the TRRC for natural gas gross withdrawals. EIA then made preliminary estimates of natural gas marketed production by subtracting out components of gross production that are not included in marketed production, such as volumes used for repressuring. Similarly, preliminary estimates of dry natural gas production were made by subtracting the volumetric loss resulting from the extraction of natural gas liquids at natural gas processing plants from marketed natural gas production. These estimates were made using EIA's established estimation methods.⁷

For the last few report months of 2004 (whose data were processed in 2005 after the TRRC changes were implemented), EIA generated empirical estimates based on prior years' month-to-month changes rather than use its established estimation methods because the TRRC changes dramatically altered the time series of production data that EIA formerly depended on to make preliminary production estimates.

⁴ Monthly production estimates are called "preliminary" when they are first published in the *Natural Gas Monthly*. After initial publication, they may be "revised" if warranted by new information. They are referred to as "final" when they are published in the *Natural Gas Annual*. The change to correct misreporting of non-indigenous CO₂ in Texas is being referred to as an "adjustment."

⁵ The TRRC will revise its gross withdrawals data for CO₂ content for 2005, but it does not plan to make similar adjustments in its 2004 data at this time.

⁶ The average absolute difference between preliminary and final Texas monthly production estimates from 1997 through 2003 was less than 2 percent.

⁷ EIA estimation methodologies and definitions are explained in [How EIA Estimates Natural Gas Production](#).

(2) Revisions to Preliminary Estimates for 2005

In January 2005, EIA initiated Form EIA-914, *Monthly Natural Gas Production Report*, which collects monthly production data from a sample of well operators in six geographical areas, including Texas. Estimates of monthly natural gas production from the EIA-914 survey are posted on the EIA website.¹ Although the EIA-914 estimates are not yet official, because of the serious impact of the TRRC changes EIA used the EIA-914 estimates to revise preliminary estimates for Texas production for 2005 and, starting with the October 2005 report month, the EIA-914 estimates will be the basis of EIA's official Texas preliminary production estimates.

(3) Adjustments for CO₂

For 2005 data, gross withdrawals production estimates based on EIA-914 data can be directly adjusted to account for CO₂ production because respondents report two values to EIA - gross withdrawals and lease production⁸ - and the difference between these two values is primarily equal to non-indigenous injected CO₂ volumes (for those respondents operating CO₂ injection projects). To obtain adjustments for 2004 data, the ratio of the 2005 CO₂ adjustment to the total natural gas produced by the impacted operators in 2005 was used to estimate the 2004 CO₂ adjustment factor. The resulting annual 2004 CO₂ adjustment for Texas is consistent with 2004 data from the EIA-23, "Annual Survey of Domestic Oil and Gas Reserves," which do not include injected CO₂. It is expected that the estimates will be consistent with the volumes corrected for CO₂ that the TRRC has requested from operators.

Results

Figure 1 and Table 1 show preliminary and revised estimates of 2004 and 2005 Texas natural gas marketed production (on an average daily basis by month, in billion cubic feet per day, Bcf/day) before adjusting for non-indigenous CO₂. These preliminary estimates were previously published in the *Natural Gas Monthly* as monthly volumes; the average daily rates by month are shown here because they reveal trends more readily. The revisions to the 2004 preliminary estimates were made using the more current TRRC data now available. The revisions to the 2005 preliminary estimates were made using the new EIA-914, "Natural Gas Monthly Production Report," survey data.

Figure 2 and Table 2 show the revised estimates of 2004 and 2005 Texas natural gas marketed production (on an average daily basis by month, in billion cubic feet per day, Bcf/day) before and after the CO₂ adjustments were made (i.e., with and without inclusion of non-indigenous CO₂). Table 3 shows all the estimates (preliminary, revised and adjusted for CO₂) on the monthly basis used in the *NGM* (in billion cubic feet, Bcf).

Changes to 2004 Production Estimates:

- **Revisions:** Table 1 and Figure 1 show that revisions resulting from using more current Texas data for 2004 range from - 2.2 percent to + 3.0 percent, with an average absolute revision of 1.3 percent, magnitudes that are typical of past revisions. Previously published EIA estimates showed production declining at an annualized rate of about 3 percent during 2004, but the revised estimates (before adjusting for CO₂) show an annualized growth rate of about 2 percent during 2004.
- **Adjustments for CO₂:** Table 2 and Figure 2 show that after the 2004 revised estimates were adjusted for non-indigenous CO₂, production estimates showed an annualized growth rate

⁸ "Lease production" is defined as gross withdrawals less nonhydrocarbon gases removed on the lease, gas vented and flared and gas used for repressuring or as lease fuel.

of about 0.2 percent during 2004 (in contrast to a 3 percent annualized decline rate before the revisions and adjustments for CO₂ were made).

Changes to 2005 Production Estimates:

- **Revisions:** Using EIA-914 data for the first five months of 2005, the revisions to preliminary production estimates were larger than past revisions, steadily growing from -0.4 percent in January to +4 percent in May. (Because the early preliminary TRRC natural gas production data were much lower than usual during the first 5 months of 2005, EIA's empirical method did not capture the full impact of record-setting drilling in Texas in late 2004 and in 2005, as the EIA-914 data did.)
- **Adjustments for CO₂:** Production estimates for the first 7 months of 2005 based on EIA-914 data adjusted for CO₂ show an annualized production growth rate of about 6 percent, a significant increase for the largest producing state.⁹ It's important to note that if EIA had adjusted for non-indigenous CO₂ in 2005 Texas production estimates but not in 2004 estimates, it would have erroneously appeared that there was a precipitous drop in Texas natural gas production in the first quarter of 2005 (see Figure 2). It also would have caused 2005 US production estimates to show a drop from 2004 levels because a 6 percent drop in Texas production estimates would cause a 2 percent drop in U.S. production estimates (other factors remaining constant).

The result of these changes to production estimates is that natural gas production in Texas during 2004 and the first half of 2005 was growing, not declining; and because Texas is the largest producing state, the 2004 and 2005 Texas CO₂ adjustments are necessary for recent US production trends to be accurately discerned.

⁹ Texas, with about 27 percent of marketed natural gas production in the Lower 48 states, is the largest natural gas producing state (EIA *Natural Gas Annual 2003*, Table 2).

Figure 1. EIA Preliminary (Published) and Revised Texas Marketed Gas Production Estimates (Without Adjustments for Non-Indigenous CO₂) 2004-2005 (Bcf/day)

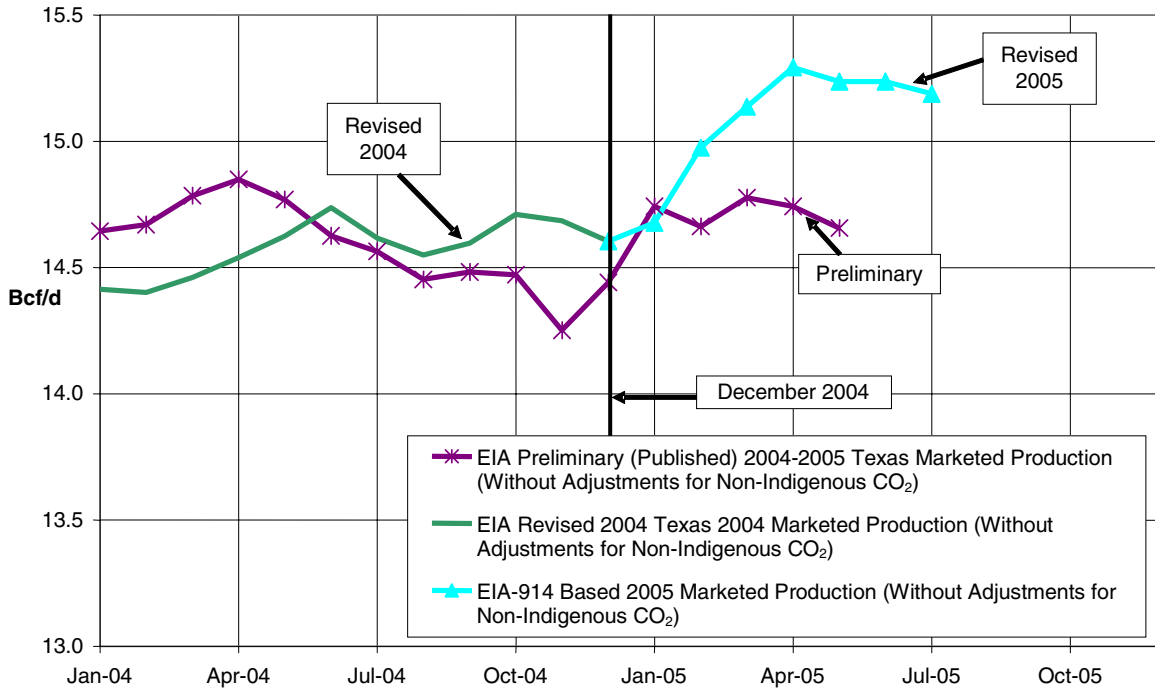


Figure 2. EIA Revised Texas Marketed Gas Production Estimates (With and Without Adjustments for Non-Indigenous CO₂) (2004-2005 (Bcf/day))

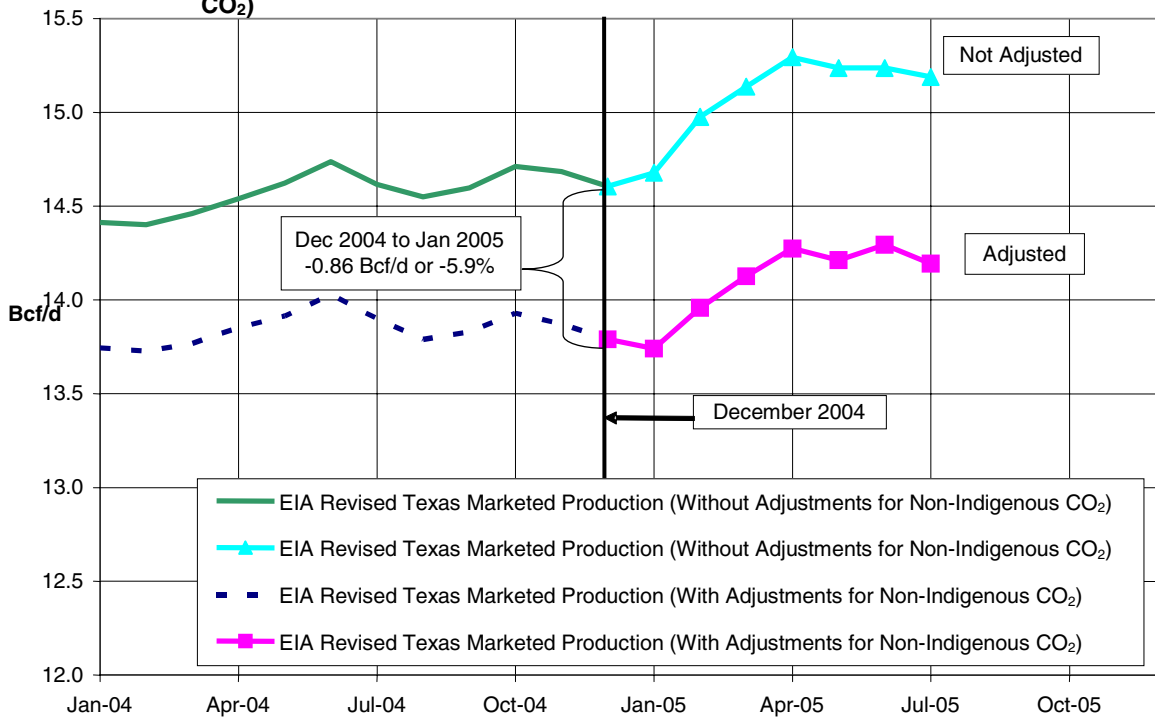


Table 1. EIA Preliminary (Published) and Revised Texas Marketed Gas Production Estimates (Without Adjustments for Non-Indigenous CO₂) 2004-2005 (Bcf/day)

Month	EIA Preliminary (Published) Texas Marketed Gas Production Estimates (Without Adjustments for Non-Indigenous CO ₂) (Bcf/day)	EIA Revised Texas Marketed Gas Production Estimates (Without Adjustments for Non-Indigenous CO ₂) (Bcf/day)	Percent Change from Preliminary to Revised
Jan-04	14.645	14.413	-1.6
Feb-04	14.670	14.402	-1.8
Mar-04	14.785	14.461	-2.2
Apr-04	14.849	14.540	-2.1
May-04	14.769	14.624	-1.0
Jun-04	14.626	14.737	0.8
Jul-04	14.564	14.616	0.4
Aug-04	14.453	14.549	0.7
Sep-04	14.483	14.597	0.8
Oct-04	14.472	14.711	1.7
Nov-04	14.252	14.684	3.0
Dec-04	14.441	14.605	1.1
Jan-05	14.743	14.678	-0.4
Feb-05	14.663	14.975	2.1
Mar-05	14.777	15.137	2.4
Apr-05	14.742	15.293	3.7
May-05	14.656	15.237	4.0
June-05		15.237	
Jul-05		15.188	

Table 2. EIA Revised Texas Marketed Gas Production Estimates (With and Without Adjustments for Non-indigenous CO₂) 2004-2005 (Bcf/day)

Month	EIA Revised Texas Marketed Production Estimates (Without Adjustments for Non-Indigenous CO ₂) (Bcf/day)	EIA Revised Texas Marketed Production Estimates (With Adjustments for Non-Indigenous CO ₂) (Bcf/day)	Percent Change from Revised to Adjusted
Jan-04	14.413	13.743	-4.6
Feb-04	14.402	13.727	-4.7
Mar-04	14.461	13.768	-4.8
Apr-04	14.540	13.852	-4.7
May-04	14.624	13.914	-4.9
Jun-04	14.737	14.027	-4.8
Jul-04	14.616	13.899	-4.9
Aug-04	14.549	13.790	-5.2
Sep-04	14.597	13.830	-5.3
Oct-04	14.711	13.928	-5.3
Nov-04	14.684	13.871	-5.5
Dec-04	14.605	13.790	-5.6
Jan-05	14.678	13.740	-6.4
Feb-05	14.975	13.957	-6.8
Mar-05	15.137	14.126	-6.7
Apr-05	15.293	14.274	-6.7
May-05	15.237	14.212	-6.7
June-05	15.237	14.294	-6.2
Jul-05	15.188	14.193	-6.6

Table 3. EIA Preliminary, Revised and Adjusted Texas Monthly Marketed Gas Production Estimates, 2004-2005 (Bcf)

Month	EIA Preliminary (Published) Texas Marketed Gas Production Estimates (Without Adjustments for Non-Indigenous CO₂) (Bcf)	EIA Revised Texas Marketed Gas Production Estimates (Without Adjustments for Non-Indigenous CO₂) (Bcf)	Percent Change from Preliminary to Revised	EIA Revised Texas Marketed Gas Production Estimates (With Adjustments for Non-Indigenous CO₂) (Bcf)	Percent Change from Revised to Adjusted	Total Percent Change
Jan-04	453.985	446.816	-1.6	426.042	-4.6	-6.2
Feb-04	425.427	417.659	-1.8	398.080	-4.7	-6.4
Mar-04	458.324	448.297	-2.2	426.820	-4.8	-6.9
Apr-04	445.476	436.188	-2.1	415.567	-4.7	-6.7
May-04	457.852	453.342	-1.0	431.347	-4.9	-5.8
Jun-04	438.779	442.108	0.8	420.818	-4.8	-4.1
Jul-04	451.488	453.111	0.4	430.869	-4.9	-4.6
Aug-04	448.042	451.030	0.7	427.484	-5.2	-4.6
Sep-04	434.476	437.897	0.8	414.893	-5.3	-4.5
Oct-04	448.625	456.053	1.7	431.782	-5.3	-3.8
Nov-04	427.565	440.530	3.0	416.137	-5.5	-2.7
Dec-04	447.681	452.745	1.1	427.476	-5.6	-4.5
Jan-05	457.033	455.024	-0.4	425.946	-6.4	-6.8
Feb-05	410.577	419.307	2.1	390.803	-6.8	-4.8
Mar-05	458.081	469.235	2.4	437.894	-6.7	-4.4
Apr-05	442.270	458.788	3.7	428.218	-6.7	-3.2
May-05	454.345	472.341	4.0	440.566	-6.7	-3.0
June-05		457.108		428.818	-6.2	
Jul-05		470.825		439.980	-6.6	